
Performance and power efficiency of Dell 13G PowerEdge servers with the Intel Xeon E5-2600 v3 product family

This white paper details the performance and power efficiency improvements of Dell™ PowerEdge™ servers with the Intel® Xeon® processor E5-2600 v3 product family.



Solutions Performance Analysis

Dell | Global Solutions Engineering



This document is for informational purposes only and may contain typographical errors and technical inaccuracies. The content is provided as is, without express or implied warranties of any kind.

©2015 Dell Inc. All rights reserved. Dell and its affiliates cannot be responsible for errors or omissions in typography or photography. Dell, the Dell logo, and PowerEdge are trademarks of Dell Inc. Intel and Xeon are registered trademarks of Intel Corporation in the U.S. and other countries. Microsoft, Windows, and Windows SQL Server are either trademarks or registered trademarks of Microsoft Corporation in the United States and/or other countries. Other trademarks and trade names may be used in this document to refer to either the entities claiming the marks and names or their products. Dell disclaims proprietary interest in the marks and names of others.

Members of Dell's Solutions Performance Analysis team contributing to this whitepaper are: Brian Bassett, John Beckett, Burton Culley, Waseem Raja, Donald Russell, Bruce Wagner and Juergen Zimmermann.

April 2015 | Version 1.21

Contents

Executive summary	5
Introduction	5
Key findings	5
Performance with E5-2600 v3.....	5
Methodology	6
Integer performance.....	7
SPEC CPU2006 integer tests.....	7
Floating point performance.....	8
SPEC CPU2006 floating point tests	8
HPC performance tests	9
Memory subsystem performance	10
Workloads performance	11
Business Functions	11
Power Efficiency	13
Summary	14
Appendix A — Test configurations	15

Tables

Table 1: Benchmark configurations	15
---	----

Figures

Figure 1: Performance improvement running SPECint_rate_base2006.....	7
Figure 2: Performance improvement running SPECfp_rate_base2006	8
Figure 3: Performance improvement running Linpack	9
Figure 4: Performance improvement running STREAM	10
Figure 5: Performance improvement running SAP SD 2-Tier	11
Figure 6: Performance improvement running HiBench K-Means Clustering benchmark	12
Figure 7: Power efficiency improvement of the R730 running the SPECpower_ssj2008 benchmark....	13

Executive summary

Introduction

Dell's 13th generation PowerEdge servers are now available with the Intel Xeon processor E5-2600 v3 product family, code named "Haswell-EP". These new Xeon processors feature up to 18 cores and share the previous generation's 22-nanometer process for improved power efficiency.

In order to show customers the performance and power efficiency improvements that E5-2600 v3 processors bring to PowerEdge 13G servers, Dell's Solutions Performance Analysis team performed a series of benchmarks and compared the results to those obtained using the on PowerEdge 12G servers with the Intel Xeon processor E5-2600 v2 product family, code named "Ivy Bridge-EP".

Based on the results of performed testing, PowerEdge 13G servers with E5-2600 v3 processors perform up to 108% better, compared to the 12G PowerEdge servers running E5-2600 v2 processors.

Key findings

Performance with E5-2600 v3

- **PowerEdge 13G servers with two E5-2699 v3 processors achieved up to 108% higher gigaFLOPS** running the Linpack scientific-computing benchmark.
- **PowerEdge 13G servers with two E5-2699 v3 processors achieved up to a 61% higher score on the SAP-SD two-tier benchmark.**
- **PowerEdge 13G servers with two E5-2699 v3 processors are 21% more power efficient than the previous generation PowerEdge servers.**

Methodology

To highlight the performance improvements gained by PowerEdge servers running E5-2600 v3 processors, few configuration changes were made between those runs and the runs with E5-2600 v2 processors that were used for comparison. However, as PowerEdge servers with E5-2600 v3 processors support up to 16 DDR4 RDIMMs running at 2133 MT/s, that speed memory was used in most benchmarks, except as noted in Appendix A.

Integer performance

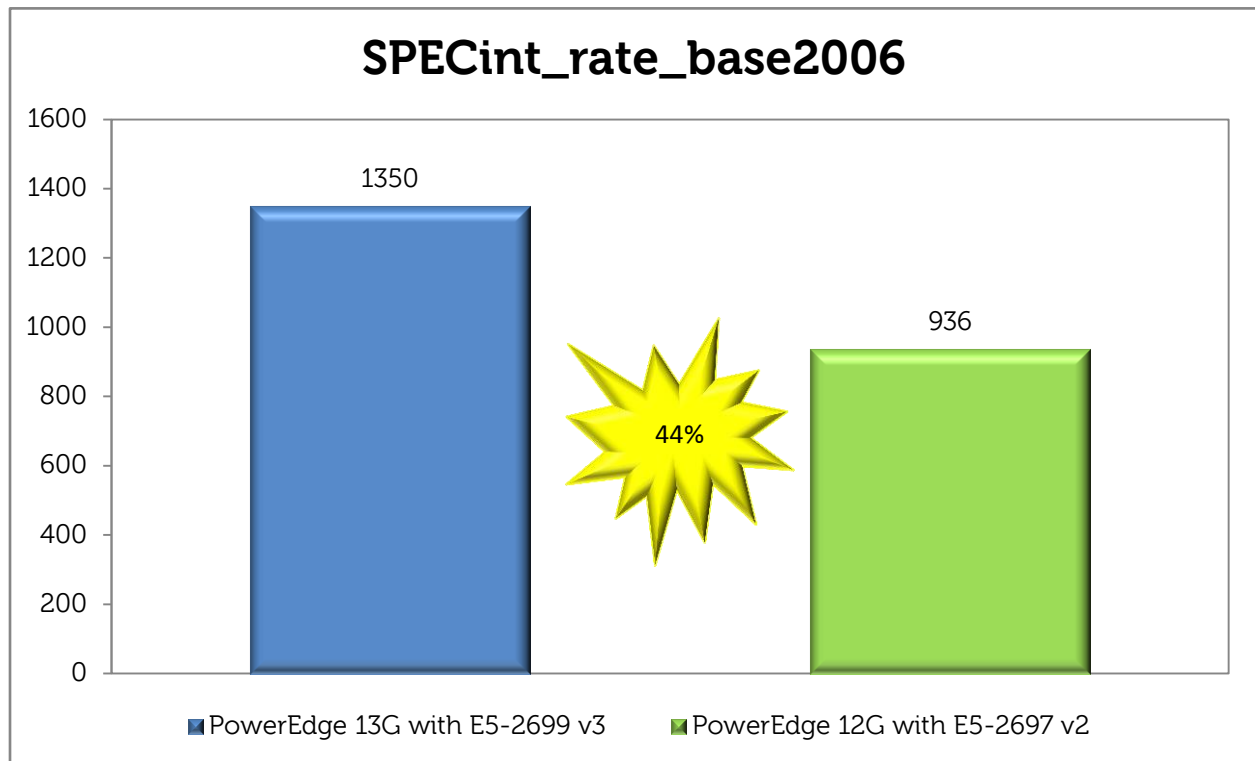
SPEC CPU2006 integer tests

The industry standard SPEC CPU2006 benchmark is [described on SPEC.org](http://www.spec.org) as:

CPU2006 is SPEC's next-generation, industry-standardized, CPU-intensive benchmark suite, stressing a system's processor, memory subsystem and compiler. SPEC designed CPU2006 to provide a comparative measure of compute-intensive performance across the widest practical range of hardware using workloads developed from real user applications.

The integer portion of the benchmark is particularly good at measuring a server's ability to run general business applications. In Figure 1, we see a 44% improvement in the SPECint_rate benchmark with E5-2600 v3 processors.

Figure 1: Performance improvement running SPECint_rate_base2006

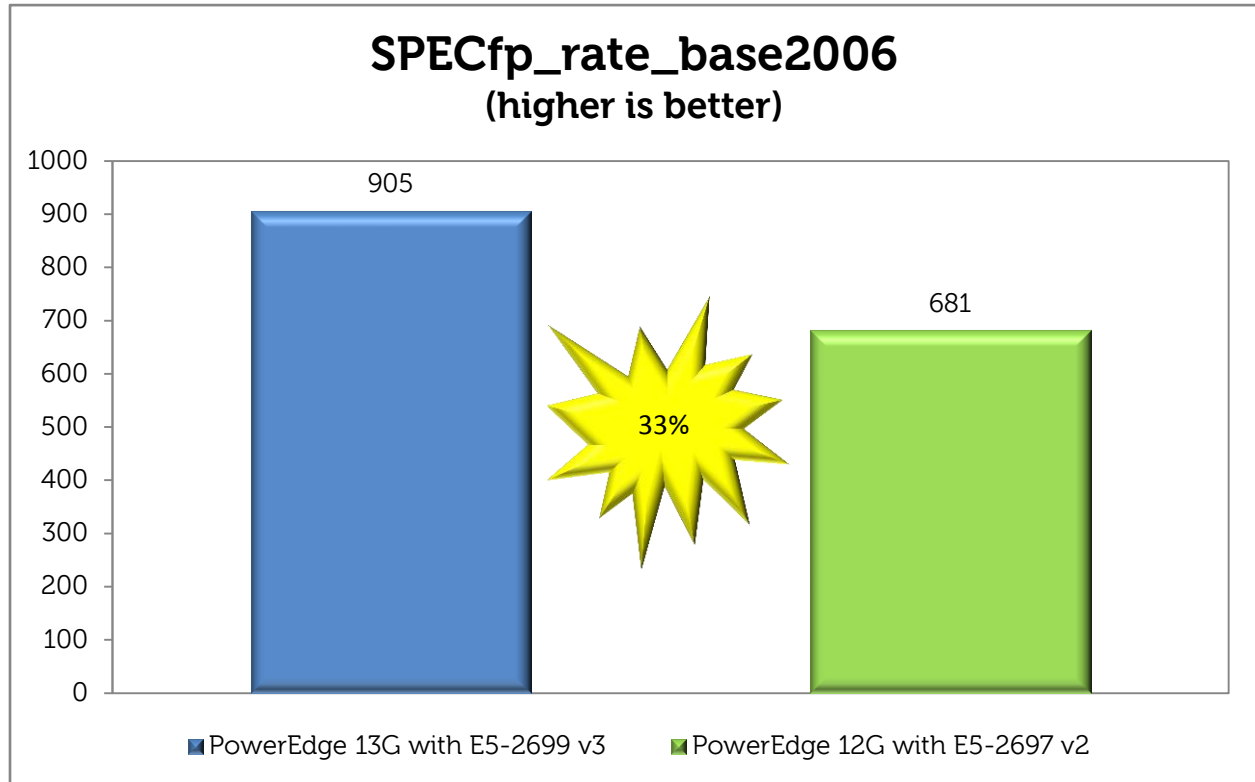


Floating point performance

SPEC CPU2006 floating point tests

Floating point performance is important to those running science, simulations and HPC workloads. SPEC CPU2006 contains a suite of floating point tests which when in "rate" (multithreaded) mode, show a 33% performance improvement with E5-2699 v3, as seen in Figure 2.

Figure 2: Performance improvement running SPECfp_rate_base2006

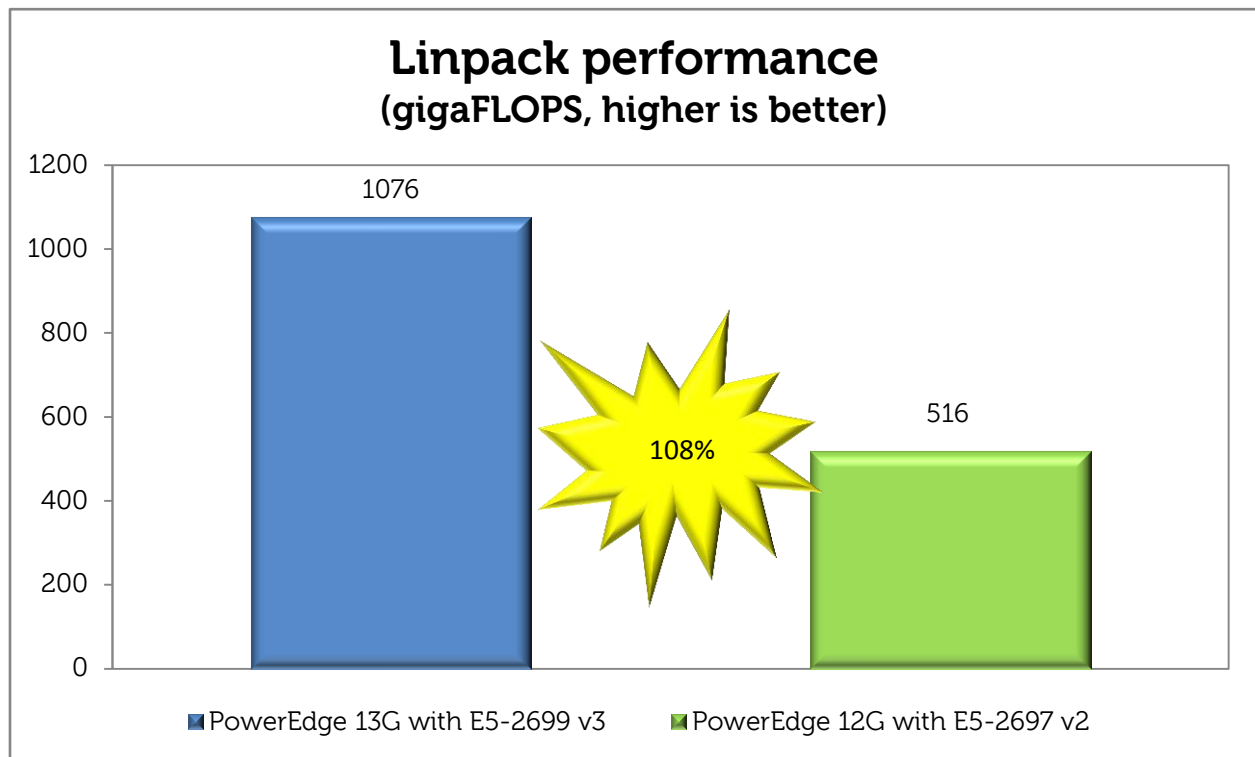


HPC performance tests

The Linpack benchmark is used to measure a system's floating point processing power by solving linear equations. We ran the Intel Optimized Linpack Benchmark against a single node using both generations of processors.

Ivy Bridge EP introduced AVX 1.0 instructions, which allowed the processor to perform eight double precision floating point operations (DP Flops) per clock cycle. Thanks to Haswell EP's support of AVX 2.0 instructions, which can perform 16 DP Flops per clock cycle, E5-2699 v3 shows a 108% performance improvement over E5-2697 v2, as seen in Figure 3.

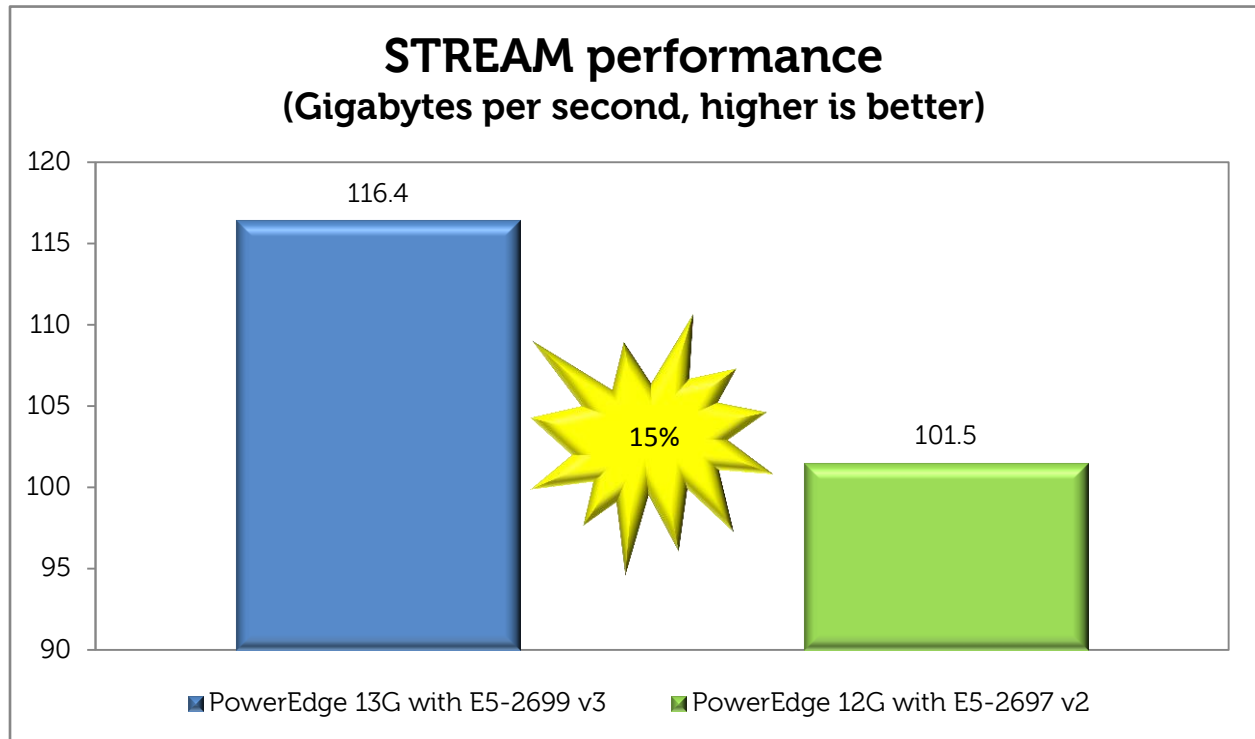
Figure 3: Performance improvement running Linpack



Memory subsystem performance

Many workloads benefit from greater memory bandwidth. Dell PowerEdge servers running E5-2699 v3 processors support up to 16 DDR4 RDIMMs running at 2133 MT/s. In Figure 4, the STREAM memory bandwidth benchmark shows a 15% improvement in system memory bandwidth performance thanks to the faster memory and additional cores of the E5-2699 v3.

Figure 4: Performance improvement running STREAM



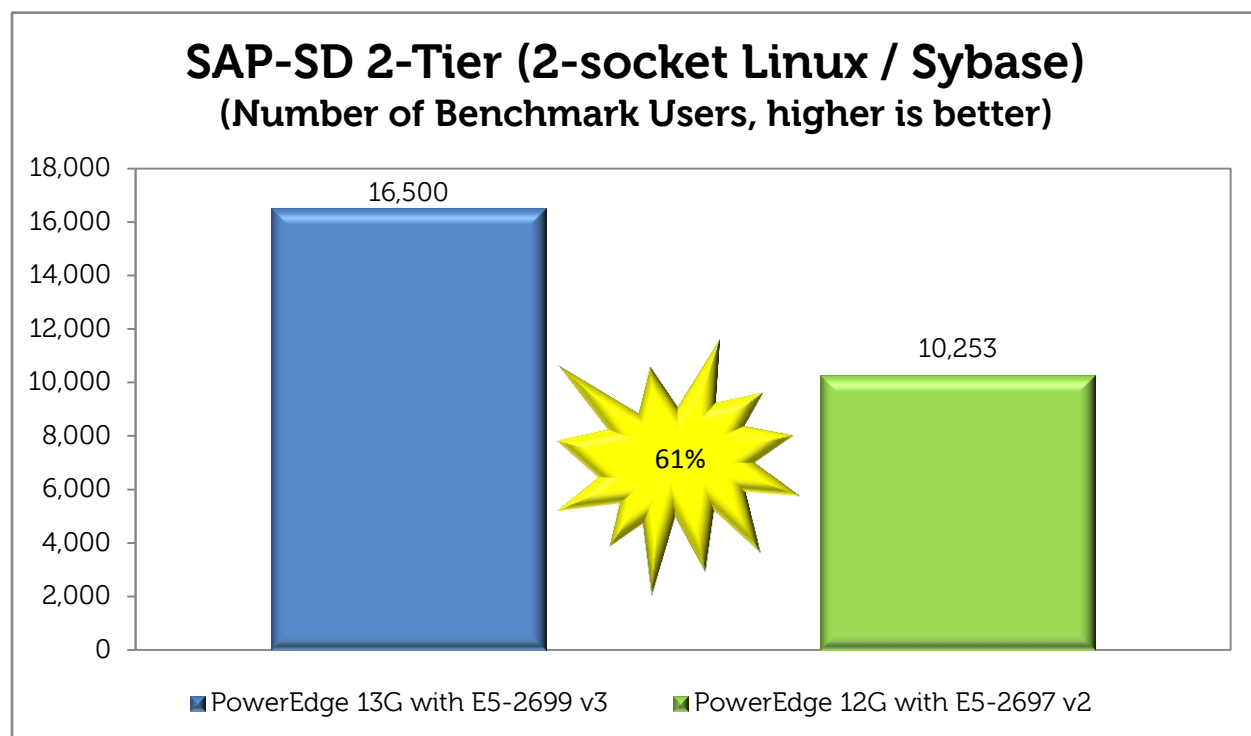
Workloads performance

Business Functions

The SAP SD (Sales and Distribution) benchmark is described on the [SAP web site](#) as:

The Sales and Distribution (SD) Benchmark covers a sell-from-stock scenario, which includes the creation of a customer order with five line items and the corresponding delivery with subsequent goods movement and invoicing.

Figure 5: Performance improvement running SAP SD 2-Tier



The SAP-SD Two-Tier benchmark's primary metric is the Number of Benchmark Users. As Figure 5 shows, the published result for PowerEdge R730 in this benchmark is 56% higher¹ than the previous highest score on E5-2697 v2², which was achieved on Dell's R720 platform³.

¹ Results of the Dell PowerEdge R730 on the two-tier SAP SD standard application benchmark: 16,500 SAP SD benchmark users with the SAP enhancement package 5 for SAP ERP 6.0, Red Hat Enterprise Linux 7, and Sybase ASE 16, 2 x Intel Xeon E5-2699 v2 processors (36 cores, 72 threads), 256 GB main memory. Certification number 2014033.

² Results of the Dell PowerEdge R720 on the two-tier SAP SD standard application benchmark: 10,253 SAP SD benchmark users with the SAP enhancement package 5 for SAP ERP 6.0, Red Hat Enterprise Linux 6.5, and Sybase ASE 16, 2 x Intel Xeon E5-2697 v2 processors (24 cores, 48 threads), 256 GB main memory. Certification number 2014017.

³ Results as of September 10, 2014. For more details see <http://www.sap.com/benchmark>.

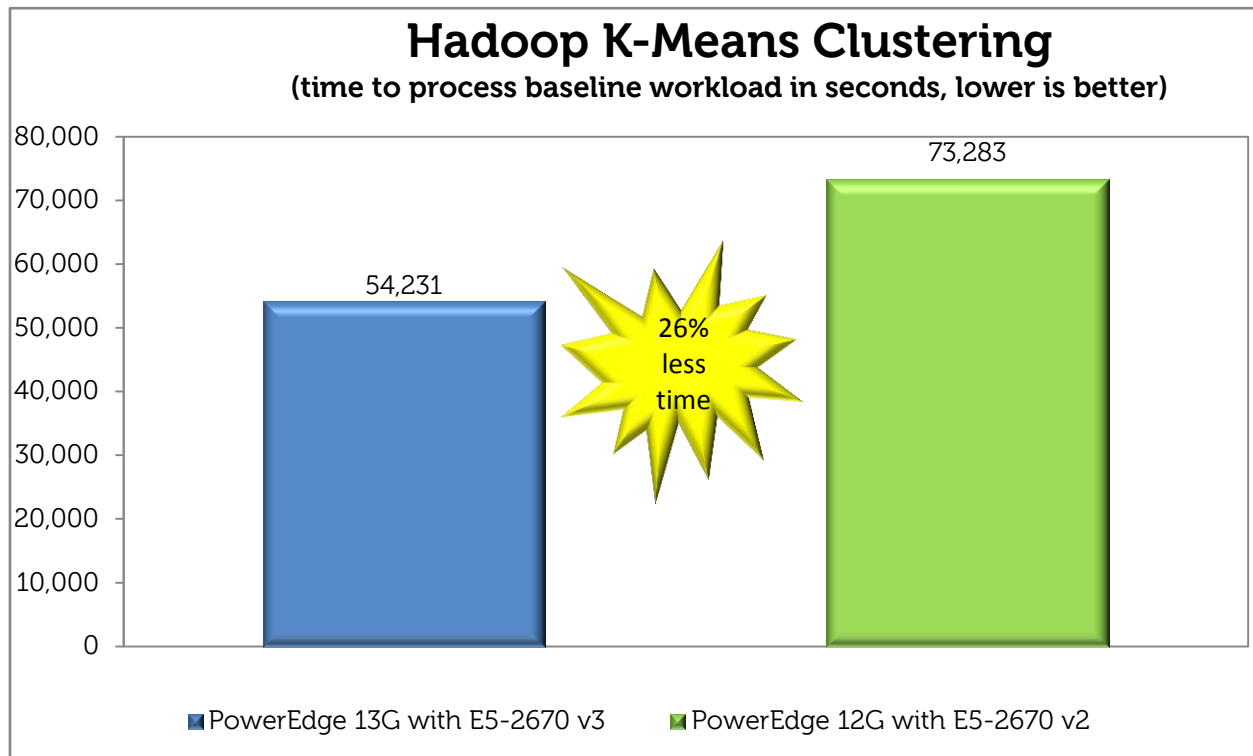
Big data

The Apache™ Hadoop® software library is described by the Apache Hadoop Project Team as:

...a framework that allows for the distributed processing of large data sets across clusters of computers using simple programming models.

Dell tests the performance of our servers using HiBench 2.2. While many of the sub-benchmarks of HiBench are bound by storage performance thus seeing minimal improvement from processor upgrades, the K-Means Clustering sub-benchmark has a substantial processor component. In this sub-benchmark, time to complete a workload is measured, with a lower number of seconds being better. With two E5-2670 v3 processors, the workload was completed in 26% less time on R730xd compared to the same workload in an R720xd with two E5-2670 v2 processors.

Figure 6: Performance improvement running HiBench K-Means Clustering benchmark

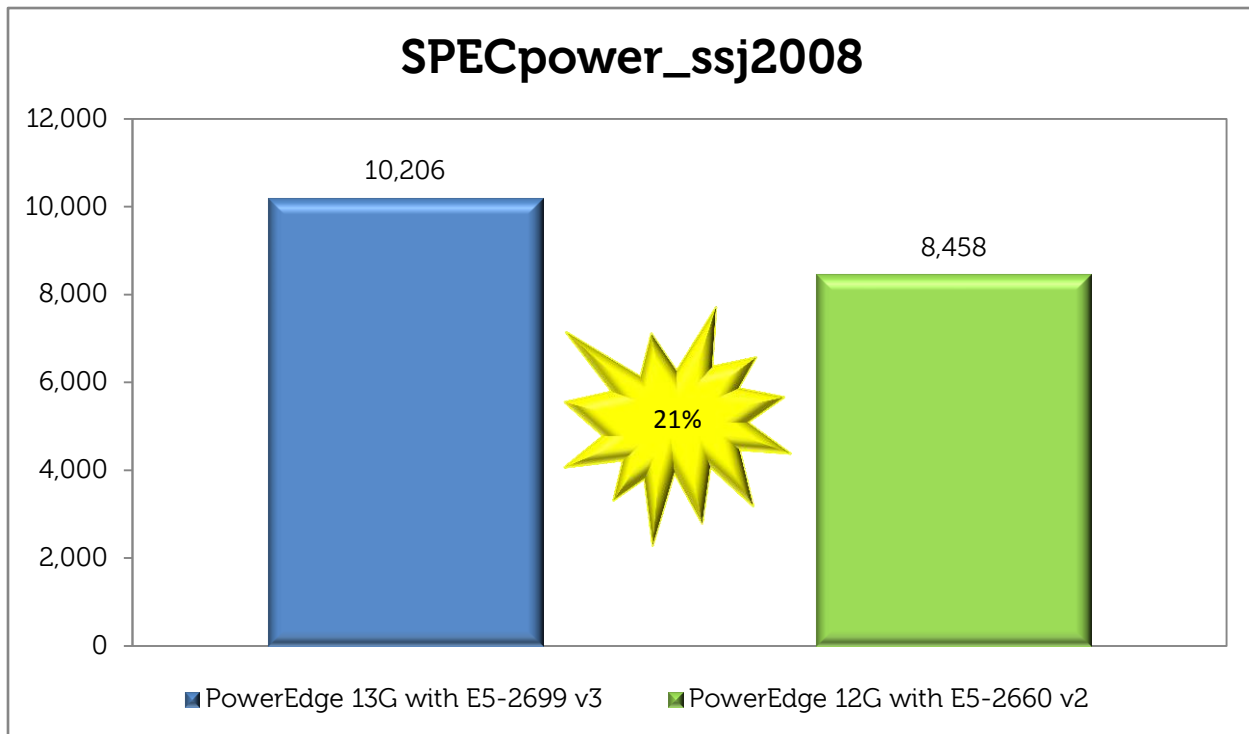


Power Efficiency

The SPECpower_ssj2008 benchmark measures the performance of a server or servers running a server-side Java workload, and measures the power consumed during the workload to produce a performance-per-watt metric.

The greater power efficiency and improved performance of E5-2600 v2 processors leads to a 21% increase in the PowerEdge R720's overall score on the SPECpower_ssj2008 benchmark.

Figure 7: Power efficiency improvement of the R730 running the SPECpower_ssj2008 benchmark



Summary

Performance improvements on PowerEdge 13G servers with E5-2600 v3 processors will depend on the workload being run. Integer workload performance has taken a leap forward with 13G, with the commonly used SPECint_rate benchmark seeing as much as a 44% score improvement. Scientific workloads such as Linpack can see performance improvements of as much as 108% thanks to the addition of AVX 2.0 instructions.

Workloads with a heavy storage component benefit somewhat less from the additional processing power brought by the upgrade of E5-2600 v3 processors. Even so, the Hadoop K-Means Clustering benchmark saw a 26% reduction in the time required to complete the operation when running on E5-2670 v3 processors.

The E5-2600 v3 product family is available for purchase on all PowerEdge 13G servers. The enhanced performance of the 13G server lineup continues the PowerEdge tradition of delivering the maximum performance today's datacenter administrators demand.

Appendix A — Test configurations

Table 1: Benchmark configurations

Benchmark	Processor quantity	E5-2600 v3 family processor	DIMM quantity	DIMM specifications
SPECint_rate_base2006	2	E5-2699 v3	16	16GB 2R 2133 MT/s RDIMMs
SPECfp_rate_base2006	2	E5-2699 v3	16	16GB 2R 2133 MT/s RDIMMs
STREAM	2	E5-2699 v3	16	16GB 2R 2133 MT/s RDIMMs
Linpack	2	E5-2699 v3	16	16GB 2R 2133 MT/s RDIMMs
SAP SD Two-Tier	2	E5-2699 v3	16	16GB 2R 2133 MT/s RDIMMs
Hadoop	2	E5-2670 v3	16	16GB 2R 2133 MT/s RDIMMs
SPECpower_ssjs2008	2	E5-2699 v3	8	8GB 2R 2133 MT/s RDIMMs